This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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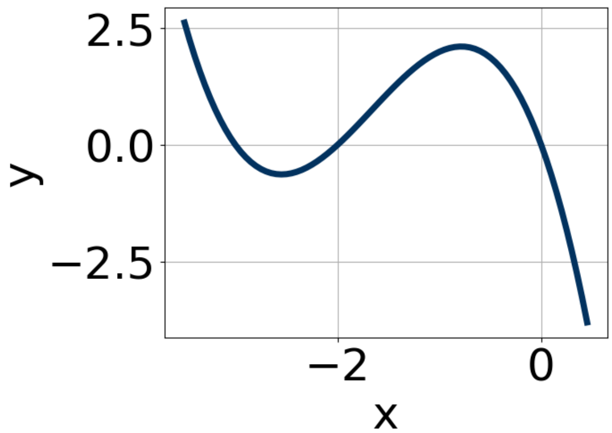
1. Which of the following equations *could* be of the graph presented below?



The solution is $-19x^{11}(x+2)^9(x+3)^9$, which is option A.

A. $-19x^{11}(x+2)^9(x+3)^9$

* This is the correct option.

B. $8x^7(x+2)^{11}(x+3)^9$

This corresponds to the leading coefficient being the opposite value than it should be.

C. $-2x^9(x+2)^{10}(x+3)^8$

The factors -2 and -3 have have been odd power.

D. $-19x^5(x+2)^8(x+3)^9$

The factor -2 should have been an odd power.

E. $15x^9(x+2)^6(x+3)^7$

The factor $(x+2)$ should have an odd power and the leading coefficient should be the opposite sign.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

2. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form ax^3+bx^2+cx+d.

$$\frac{-3}{2}, -7, \text{ and } \frac{7}{2}$$

The solution is $4x^3+20x^2-77x-147$, which is option A.

A. $a \in [1, 7], b \in [20, 23], c \in [-77, -71],$ and $d \in [-149, -143]$

 * $4x^3 + 20x^2 - 77x - 147$, which is the correct option.

B. $a \in [1, 7], b \in [-20, -13], c \in [-77, -71],$ and $d \in [147, 150]$

 $4x^3 - 20x^2 - 77x + 147$, which corresponds to multiplying out $(2x - 3)(x - 7)(2x + 7)$.

C. $a \in [1, 7], b \in [6, 15], c \in [-120, -118],$ and $d \in [147, 150]$

 $4x^3 + 8x^2 - 119x + 147$, which corresponds to multiplying out $(2x - 3)(x + 7)(2x - 7)$.

D. $a \in [1, 7], b \in [20, 23], c \in [-77, -71],$ and $d \in [147, 150]$

 $4x^3 + 20x^2 - 77x + 147$, which corresponds to multiplying everything correctly except the constant term.

E. $a \in [1, 7], b \in [-52, -47], c \in [158, 164],$ and $d \in [-149, -143]$

 $4x^3 - 48x^2 + 161x - 147$, which corresponds to multiplying out $(2x - 3)(x - 7)(2x - 7)$.

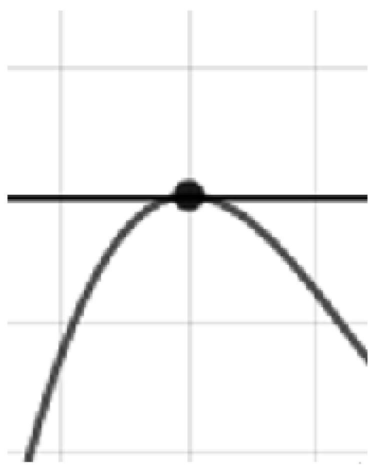
General Comment: To construct the lowest-degree polynomial, you want to multiply out $(2x + 3)(x + 7)(2x - 7)$

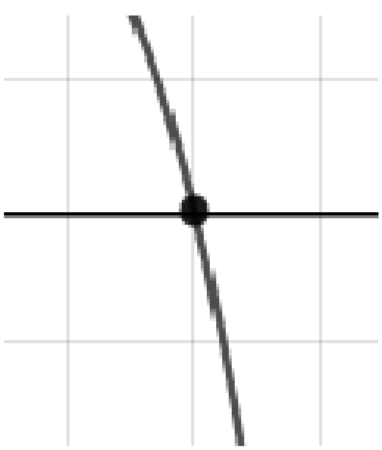
---

3. Describe the zero behavior of the zero $x = -7$ of the polynomial below.

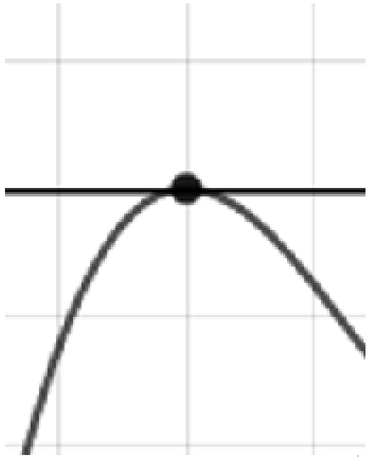
$$f(x) = -2(x - 4)^8(x + 4)^5(x + 7)^{10}(x - 7)^9$$

The solution is the graph below, which is option B.

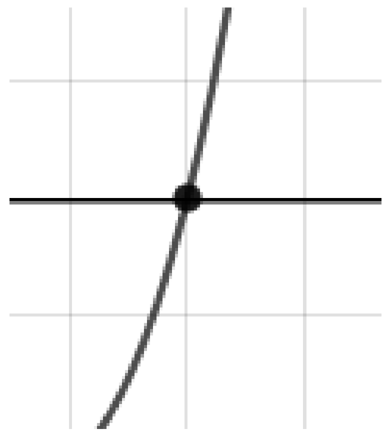




A.

B. 

C. 

D. 

E. None of the above.

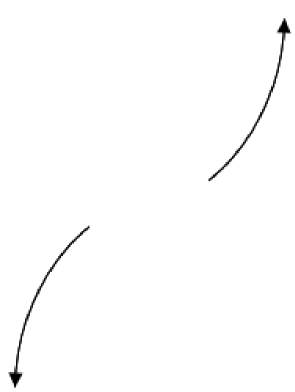
General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

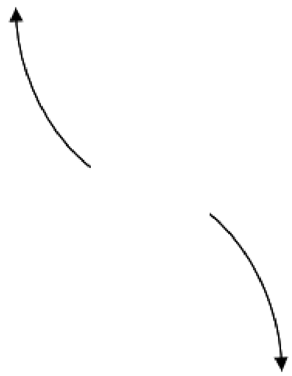
---

4. Describe the end behavior of the polynomial below.

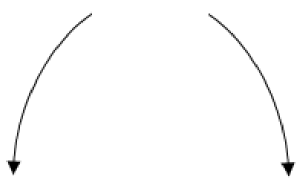
$$f(x) = 7(x-7)^2(x+7)^3(x-8)^5(x+8)^5$$

The solution is the graph below, which is option D.

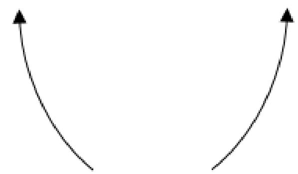




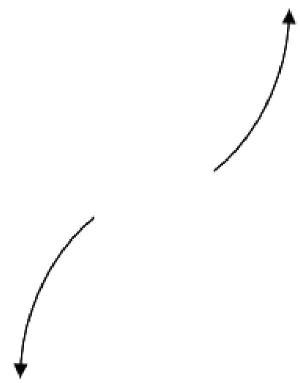
A.



B.



C.



D.

E. None of the above.

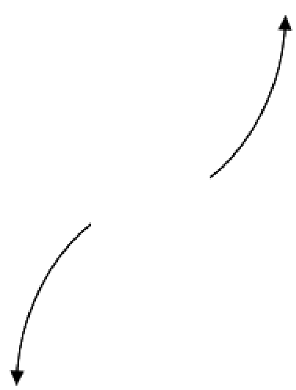
General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

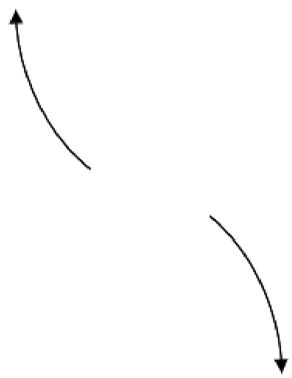
---

5. Describe the end behavior of the polynomial below.

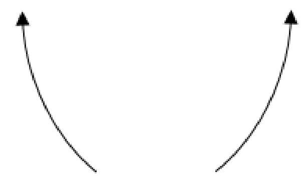
$$f(x) = 2(x-2)^4(x+2)^7(x-4)^2(x+4)^2$$

The solution is the graph below, which is option D.

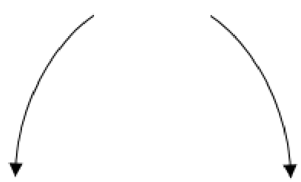




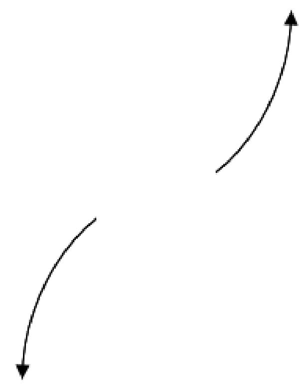
A.



C.



B.



D.

E. None of the above.

General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

---

6. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-4 + 4i \text{ and } 4$$

The solution is $x^3 + 4x^2 - 128$, which is option D.

A. $b \in [0.9, 3.2], c \in [-3, 3],$ and $d \in [-18, -14]$

$x^3 + x^2 - 16$, which corresponds to multiplying out $(x + 4)(x - 4)$.

B. $b \in [0.9, 3.2], c \in [-10, -7],$ and $d \in [13, 21]$

$x^3 + x^2 - 8x + 16$, which corresponds to multiplying out $(x - 4)(x - 4)$.

C. $b \in [-7.8, -3.9], c \in [-3, 3],$ and $d \in [121, 134]$

$x^3 - 4x^2 + 128$, which corresponds to multiplying out $(x - (-4 + 4i))(x - (-4 - 4i))(x + 4)$.

D. $b \in [3.1, 5.5], c \in [-3, 3],$ and $d \in [-130, -123]$

* $x^3 + 4x^2 - 128$, which is the correct option.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (-4 + 4i))(x - (-4 - 4i))(x - (4))$.

---

7. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$-3, \frac{-5}{2}, \text{ and } \frac{-1}{5}$$

The solution is $10x^3 + 57x^2 + 86x + 15$, which is option A.

A. $a \in [10, 15], b \in [51, 61], c \in [80, 87], \text{ and } d \in [11, 19]$

* $10x^3 + 57x^2 + 86x + 15$, which is the correct option.

B. $a \in [10, 15], b \in [-53, -46], c \in [53, 71], \text{ and } d \in [11, 19]$

$10x^3 - 53x^2 + 64x + 15$, which corresponds to multiplying out $(x - 3)(2x - 5)(5x + 1)$.

C. $a \in [10, 15], b \in [-57, -54], c \in [80, 87], \text{ and } d \in [-17, -7]$

$10x^3 - 57x^2 + 86x - 15$, which corresponds to multiplying out $(x - 3)(2x - 5)(5x - 1)$.

D. $a \in [10, 15], b \in [-3, 6], c \in [-81, -75], \text{ and } d \in [-17, -7]$

$10x^3 - 3x^2 - 76x - 15$, which corresponds to multiplying out $(x - 3)(2x + 5)(5x + 1)$.

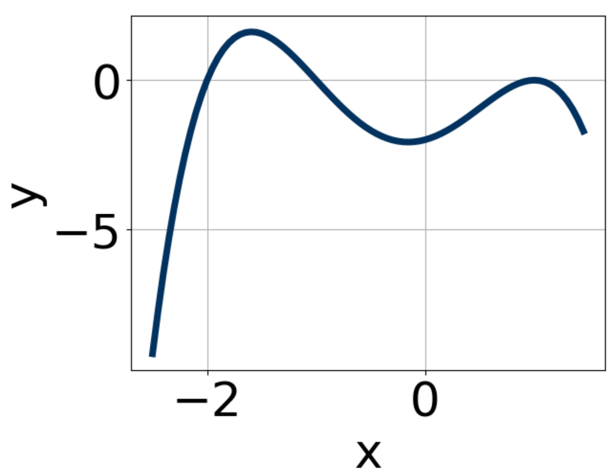
E. $a \in [10, 15], b \in [51, 61], c \in [80, 87], \text{ and } d \in [-17, -7]$

$10x^3 + 57x^2 + 86x - 15$, which corresponds to multiplying everything correctly except the constant term.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(x+3)(2x+5)(5x+1)$

---

8. Which of the following equations *could* be of the graph presented below?



The solution is $-15(x - 1)^8(x + 1)^{11}(x + 2)^7$, which is option A.

A. $-15(x - 1)^8(x + 1)^{11}(x + 2)^7$

* This is the correct option.

B. $-11(x-1)^8(x+1)^6(x+2)^9$

The factor $(x+1)$ should have an odd power.

C. $16(x-1)^8(x+1)^9(x+2)^{11}$

This corresponds to the leading coefficient being the opposite value than it should be.

D. $-14(x-1)^7(x+1)^8(x+2)^9$

The factor 1 should have an even power and the factor -1 should have an odd power.

E. $11(x-1)^4(x+1)^{11}(x+2)^4$

The factor $(x+2)$ should have an odd power and the leading coefficient should be the opposite sign.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

9. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-3 - 4i \text{ and } -2$$

The solution is $x^3 + 8x^2 + 37x + 50$, which is option C.

A. $b \in [-1, 5], c \in [1.8, 5.3], \text{ and } d \in [5.8, 6.4]$

$x^3 + x^2 + 5x + 6$, which corresponds to multiplying out $(x+3)(x+2)$.

B. $b \in [-1, 5], c \in [5.2, 8.8], \text{ and } d \in [7.7, 10.7]$

$x^3 + x^2 + 6x + 8$, which corresponds to multiplying out $(x+4)(x+2)$.

C. $b \in [4, 9], c \in [35.8, 38.9], \text{ and } d \in [46.8, 52.1]$

* $x^3 + 8x^2 + 37x + 50$, which is the correct option.

D. $b \in [-9, -3], c \in [35.8, 38.9], \text{ and } d \in [-50.4, -49]$

$x^3 - 8x^2 + 37x - 50$, which corresponds to multiplying out $(x-(-3-4i))(x-(-3+4i))(x-2)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

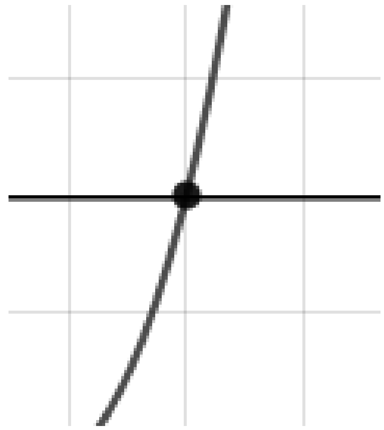
General Comment: Remember that the conjugate of $a+bi$ is $a-bi$. Since these zeros always come in pairs, we need to multiply out $(x-(-3-4i))(x-(-3+4i))(x-(-2))$.

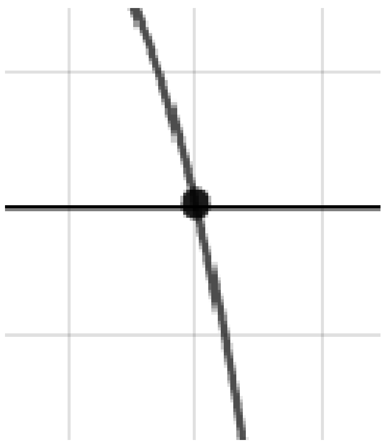
---

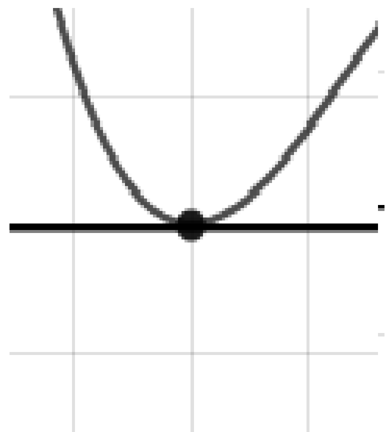
10. Describe the zero behavior of the zero $x = -8$ of the polynomial below.

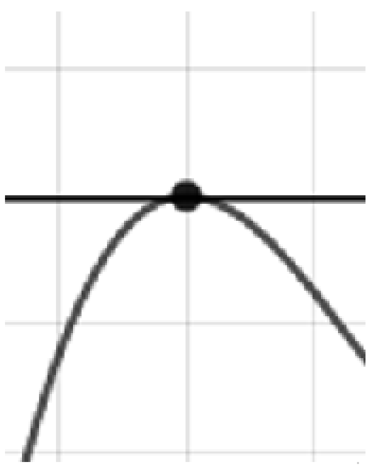
$$f(x) = -2(x-8)^8(x+8)^{11}(x+9)^9(x-9)^{13}$$

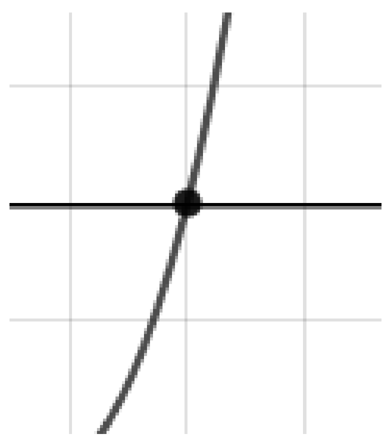
The solution is the graph below, which is option D.



A. 

C. 

B. 

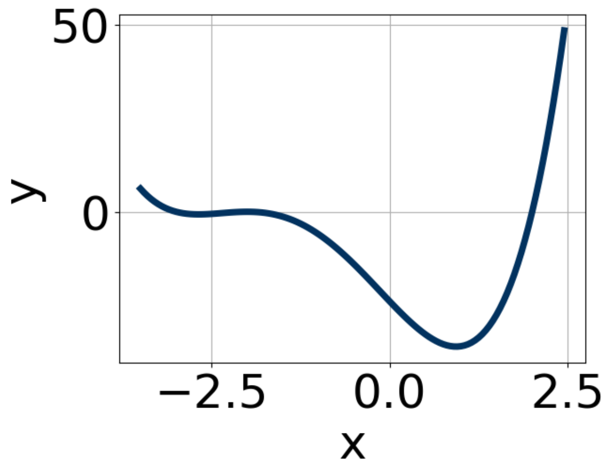
D. 

E. None of the above.

General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

---

11. Which of the following equations *could* be of the graph presented below?



The solution is $13(x+2)^4(x-2)^{11}(x+3)^{11}$, which is option C.

A. $19(x+2)^7(x-2)^4(x+3)^9$

The factor -2 should have an even power and the factor 2 should have an odd power.

B. $20(x+2)^{10}(x-2)^8(x+3)^7$

The factor $(x-2)$ should have an odd power.

C. $13(x+2)^4(x-2)^{11}(x+3)^{11}$

* This is the correct option.

D. $-18(x+2)^4(x-2)^7(x+3)^4$

The factor $(x+3)$ should have an odd power and the leading coefficient should be the opposite sign.

E. $-4(x+2)^{10}(x-2)^{11}(x+3)^5$

This corresponds to the leading coefficient being the opposite value than it should be.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

12. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form ax^3+bx^2+cx+d.

$$\frac{1}{4}, \frac{7}{5}, \text{ and } 2$$

The solution is $20x^3-73x^2+73x-14$, which is option C.

A. $a \in [17, 26], b \in [68, 75], c \in [69, 74], \text{ and } d \in [10, 16]$

$20x^3+73x^2+73x+14$, which corresponds to multiplying out $(4x+1)(5x+7)(x+2)$.

B. $a \in [17, 26], b \in [-7, -6], c \in [-59, -56], \text{ and } d \in [-18, -13]$

$20x^3-7x^2-59x-14$, which corresponds to multiplying out $(4x+1)(5x+7)(x-2)$.

C. $a \in [17, 26], b \in [-73, -66], c \in [69, 74], \text{ and } d \in [-18, -13]$

* $20x^3-73x^2+73x-14$, which is the correct option.

D. $a \in [17, 26], b \in [-73, -66], c \in [69, 74],$ and $d \in [10, 16]$

$20x^3 - 73x^2 + 73x + 14$, which corresponds to multiplying everything correctly except the constant term.

E. $a \in [17, 26], b \in [-66, -58], c \in [34, 45],$ and $d \in [10, 16]$

$20x^3 - 63x^2 + 39x + 14$, which corresponds to multiplying out $(4x + 1)(5x - 7)(x - 2)$.

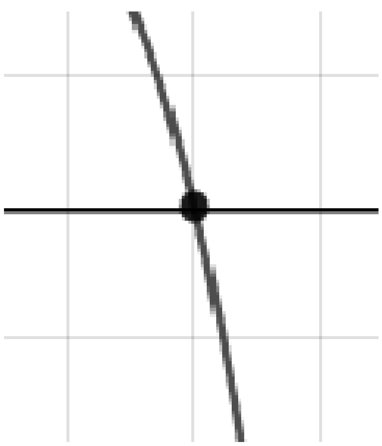
General Comment: To construct the lowest-degree polynomial, you want to multiply out $(4x - 1)(5x - 7)(x - 2)$

---

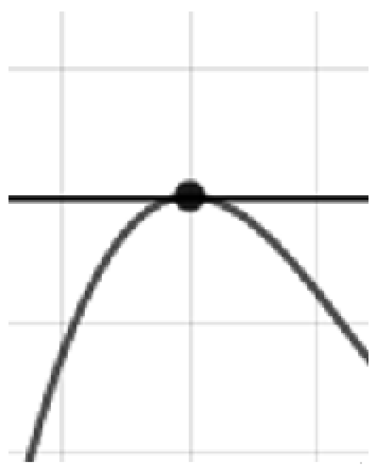
13. Describe the zero behavior of the zero $x = 2$ of the polynomial below.

$$f(x) = -9(x - 7)^7(x + 7)^4(x - 2)^{12}(x + 2)^9$$

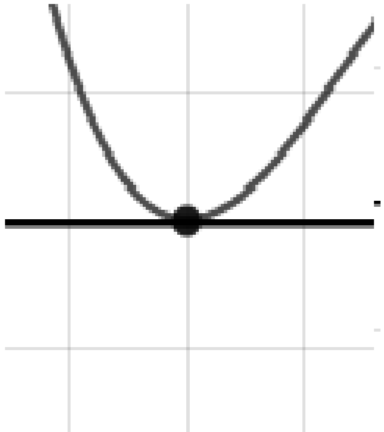
The solution is the graph below, which is option C.



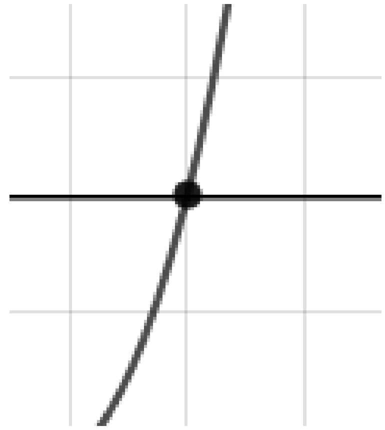
A.



B.



C.



D.

E. None of the above.

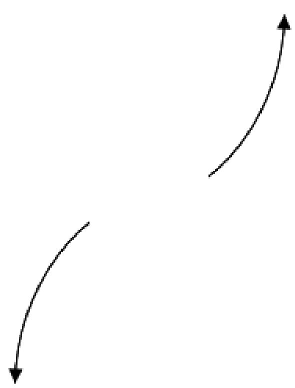
General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

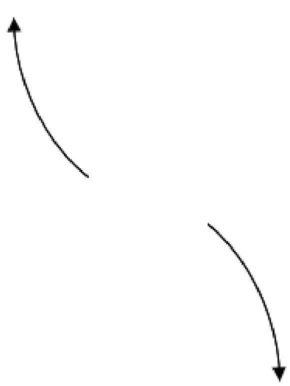
---

14. Describe the end behavior of the polynomial below.

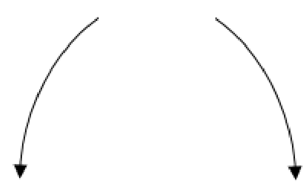
$$f(x) = 8(x-9)^2(x+9)^5(x-7)^4(x+7)^6$$

The solution is the graph below, which is option D.

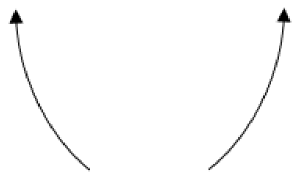




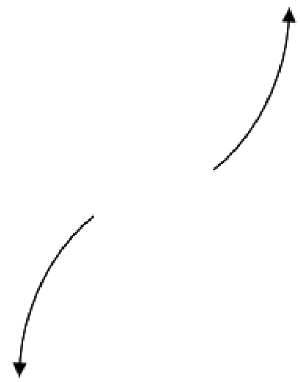
A.



B.



C.



D.

E. None of the above.

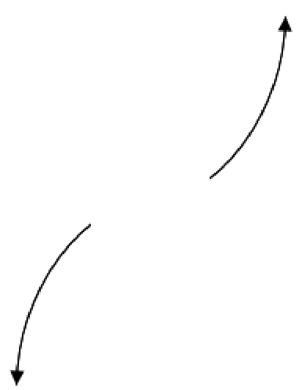
General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

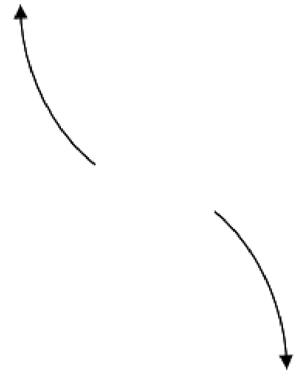
---

15. Describe the end behavior of the polynomial below.

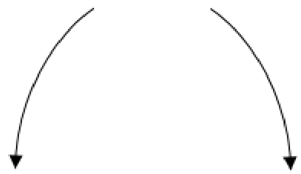
$$f(x) = 9(x+5)^3(x-5)^6(x-3)^5(x+3)^7$$

The solution is the graph below, which is option D.

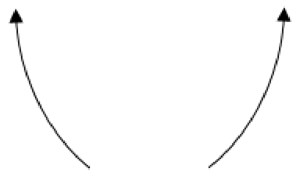




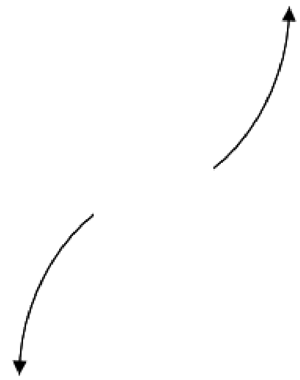
A.



B.



C.



D.

E. None of the above.

General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

---

16. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-2 + 5i \text{ and } 3$$

The solution is $x^3 + x^2 + 17x - 87$, which is option A.

A. $b \in [-0.1, 2.4], c \in [15, 24],$ and $d \in [-94, -80]$

   * $x^3 + x^2 + 17x - 87$, which is the correct option.

B. $b \in [-2.5, -0.9], c \in [15, 24],$ and $d \in [75, 89]$

   $x^3 - 1x^2 + 17x + 87$, which corresponds to multiplying out $(x - (-2 + 5i))(x - (-2 - 5i))(x + 3)$.

C. $b \in [-0.1, 2.4], c \in [-8, -3],$ and $d \in [10, 24]$

   $x^3 + x^2 - 8x + 15$, which corresponds to multiplying out $(x - 5)(x - 3)$.

D. $b \in [-0.1, 2.4], c \in [-2, 5],$ and $d \in [-10, -2]$

   $x^3 + x^2 - x - 6$, which corresponds to multiplying out $(x + 2)(x - 3)$.

E. None of the above.

   This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (-2 + 5i))(x - (-2 - 5i))(x - (3))$.

---

17. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{-3}{2}, \frac{-7}{3}, \text{ and } -4$$

The solution is $6x^3 + 47x^2 + 113x + 84$, which is option D.

A. $a \in [1, 13], b \in [42, 51], c \in [111, 117]$, and $d \in [-87, -83]$

   $6x^3 + 47x^2 + 113x - 84$, which corresponds to multiplying everything correctly except the constant term.

B. $a \in [1, 13], b \in [-4, 2], c \in [-76, -68]$, and $d \in [84, 88]$

   $6x^3 + x^2 - 71x + 84$, which corresponds to multiplying out $(2x - 3)(3x - 7)(x + 4)$.

C. $a \in [1, 13], b \in [-50, -41], c \in [111, 117]$, and $d \in [-87, -83]$

   $6x^3 - 47x^2 + 113x - 84$, which corresponds to multiplying out $(2x - 3)(3x - 7)(x - 4)$.

D. $a \in [1, 13], b \in [42, 51], c \in [111, 117]$, and $d \in [84, 88]$

   * $6x^3 + 47x^2 + 113x + 84$, which is the correct option.

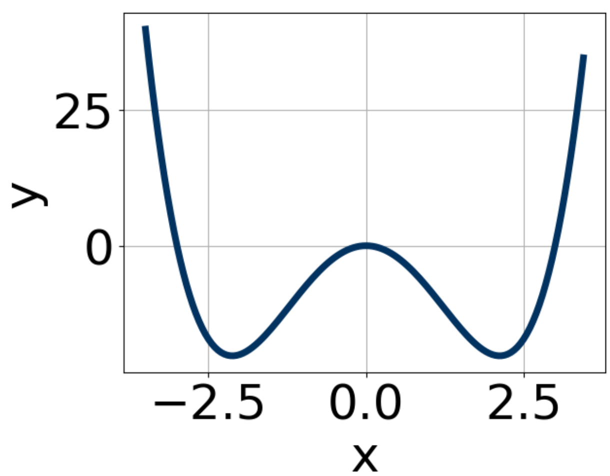
E. $a \in [1, 13], b \in [28, 30], c \in [-3, 5]$, and $d \in [-87, -83]$

   $6x^3 + 29x^2 - x - 84$, which corresponds to multiplying out $(2x - 3)(3x + 7)(x + 4)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(2x + 3)(3x + 7)(x + 4)$

---

18. Which of the following equations *could* be of the graph presented below?



The solution is $18x^8(x + 3)^9(x - 3)^7$, which is option A.

A. $18x^8(x + 3)^9(x - 3)^7$

   * This is the correct option.

B. $-19x^4(x + 3)^5(x - 3)^4$

   The factor $(x - 3)$ should have an odd power and the leading coefficient should be the opposite sign.

C. $19x^4(x + 3)^8(x - 3)^{11}$

   The factor $(x + 3)$ should have an odd power.

D. $8x^5(x + 3)^8(x - 3)^7$

   The factor 0 should have an even power and the factor -3 should have an odd power.

E. $-3x^4(x+3)^{11}(x-3)^7$

This corresponds to the leading coefficient being the opposite value than it should be.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

19. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$5 + 2i \text{ and } 4$$

The solution is $x^3 - 14x^2 + 69x - 116$, which is option B.

A. $b \in [-6, 2], c \in [-9.4, -7.5]$, and $d \in [18, 22]$

$x^3 + x^2 - 9x + 20$, which corresponds to multiplying out $(x-5)(x-4)$.

B. $b \in [-21, -8], c \in [67.5, 70.9]$, and $d \in [-126, -113]$

* $x^3 - 14x^2 + 69x - 116$, which is the correct option.

C. $b \in [-6, 2], c \in [-8, -3.8]$, and $d \in [5, 12]$

$x^3 + x^2 - 6x + 8$, which corresponds to multiplying out $(x-2)(x-4)$.

D. $b \in [12, 21], c \in [67.5, 70.9]$, and $d \in [115, 119]$

$x^3 + 14x^2 + 69x + 116$, which corresponds to multiplying out $(x-(5+2i))(x-(5-2i))(x+4)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

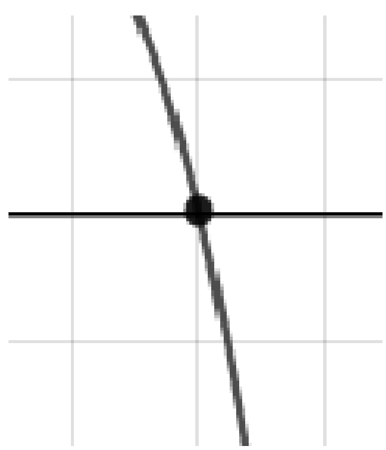
General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x-(5+2i))(x-(5-2i))(x-(4))$.

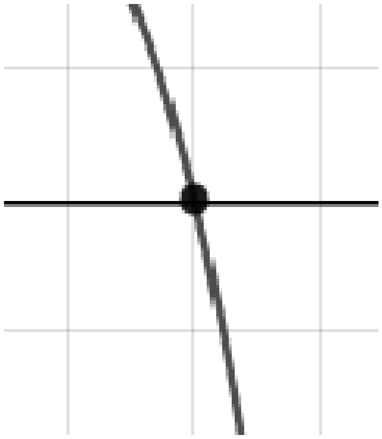
---

20. Describe the zero behavior of the zero $x = 2$ of the polynomial below.

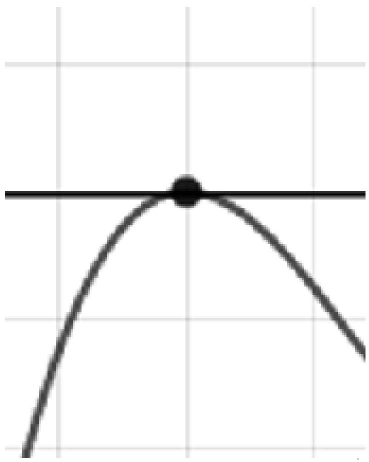
$$f(x) = 8(x+2)^2(x-2)^7(x-4)^9(x+4)^{11}$$

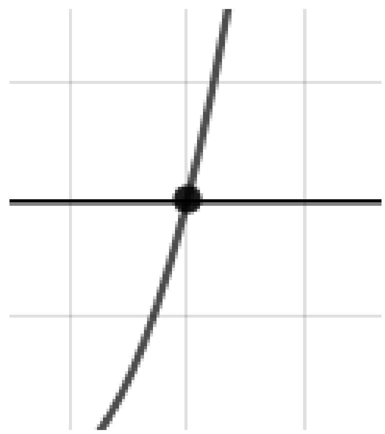
The solution is the graph below, which is option A.



A. 

C. 

B. 

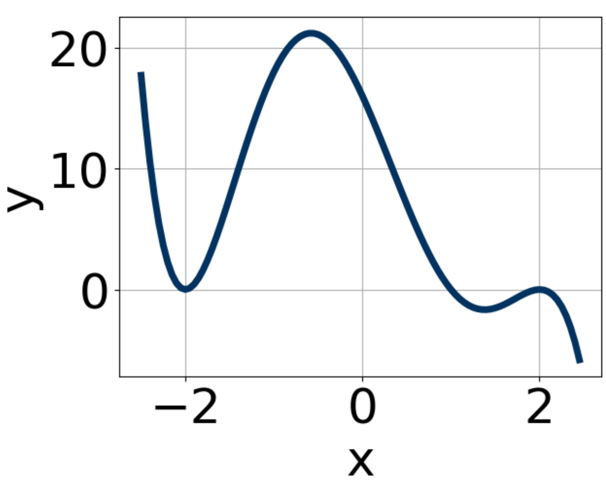
D. 

E. None of the above.

General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

---

21. Which of the following equations *could* be of the graph presented below?



The solution is $-6(x-2)^{10}(x+2)^4(x-1)^7$, which is option D.

A. $-13(x-2)^{10}(x+2)^{5}(x-1)^{10}$

   The factor $(x+2)$ should have an even power and the factor $(x-1)$ should have an odd power.

B. $-14(x-2)^{10}(x+2)^{9}(x-1)^{11}$

   The factor $(x+2)$ should have an even power.

C. $18(x-2)^{10}(x+2)^{4}(x-1)^{10}$

   The factor $(x-1)$ should have an odd power and the leading coefficient should be the opposite sign.

D. $-6(x-2)^{10}(x+2)^{4}(x-1)^{7}$

   * This is the correct option.

E. $16(x-2)^{8}(x+2)^{8}(x-1)^{5}$

   This corresponds to the leading coefficient being the opposite value than it should be.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

22. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{-3}{5}, \frac{7}{4}, \text{ and } \frac{1}{3}$$

The solution is $60x^3 - 89x^2 - 40x + 21$, which is option B.

A. $a \in [53, 63], b \in [-91, -78], c \in [-46, -37], \text{ and } d \in [-21, -18]$

   $60x^3 - 89x^2 - 40x - 21$, which corresponds to multiplying everything correctly except the constant term.

B. $a \in [53, 63], b \in [-91, -78], c \in [-46, -37], \text{ and } d \in [20, 23]$

   * $60x^3 - 89x^2 - 40x + 21$, which is the correct option.

C. $a \in [53, 63], b \in [83, 95], c \in [-46, -37], \text{ and } d \in [-21, -18]$

   $60x^3 + 89x^2 - 40x - 21$, which corresponds to multiplying out $(5x-3)(4x+7)(3x+1)$.

D. $a \in [53, 63], b \in [49, 51], c \in [-88, -79], \text{ and } d \in [20, 23]$

   $60x^3 + 49x^2 - 86x + 21$, which corresponds to multiplying out $(5x-3)(4x+7)(3x-1)$.

E. $a \in [53, 63], b \in [-165, -159], c \in [107, 112], \text{ and } d \in [-21, -18]$

   $60x^3 - 161x^2 + 110x - 21$, which corresponds to multiplying out $(5x-3)(4x-7)(3x-1)$.

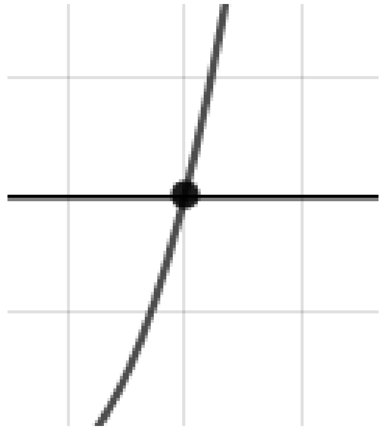
General Comment: To construct the lowest-degree polynomial, you want to multiply out $(5x+3)(4x-7)(3x-1)$

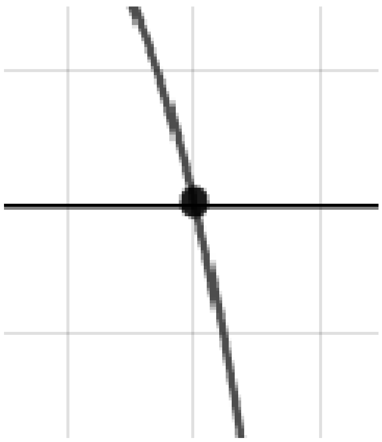
---

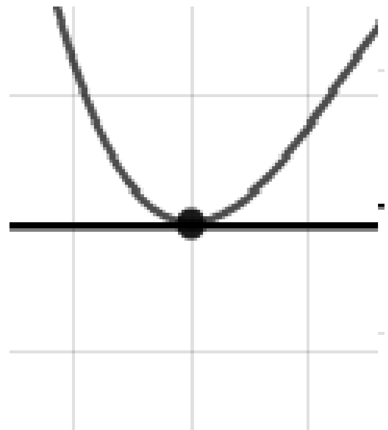
23. Describe the zero behavior of the zero $x = 8$ of the polynomial below.

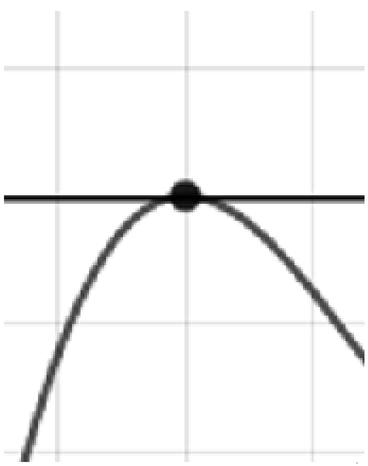
$$f(x) = 3(x+8)^{8}(x-8)^{11}(x-7)^{9}(x+7)^{13}$$

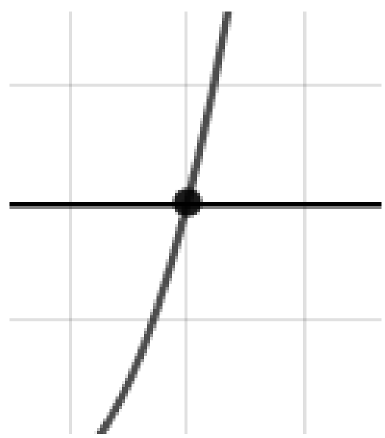
The solution is the graph below, which is option D.



A. 

C. 

B. 

D. 

E. None of the above.

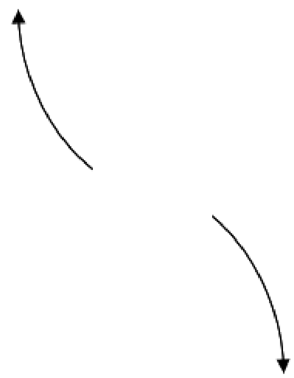
General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

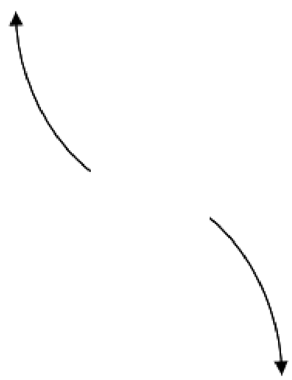
---

24. Describe the end behavior of the polynomial below.

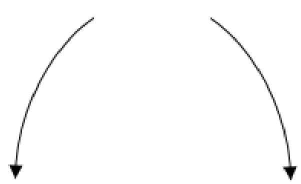
$$f(x) = -4(x+6)^4(x-6)^5(x+2)^5(x-2)^5$$

The solution is the graph below, which is option A.

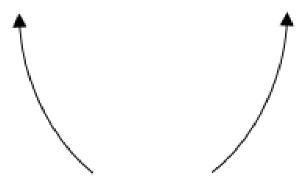




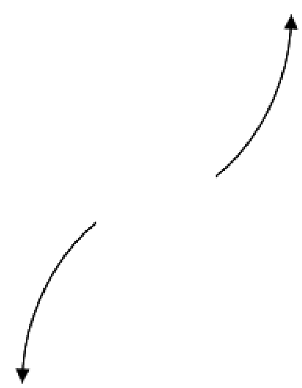
A.



B.



C.



D.

E. None of the above.

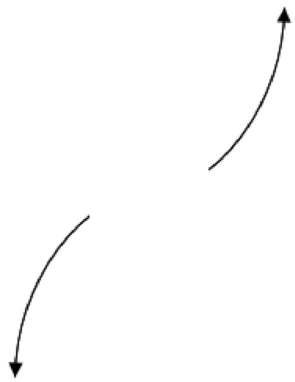
General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

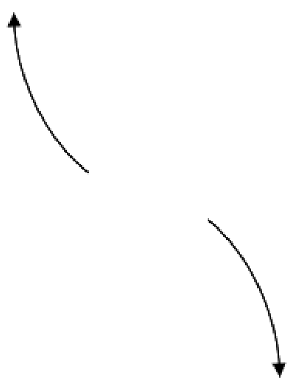
---

25. Describe the end behavior of the polynomial below.

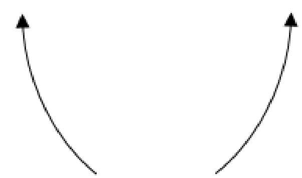
$$f(x) = 4(x+2)^5(x-2)^8(x+9)^3(x-9)^3$$

The solution is the graph below, which is option D.

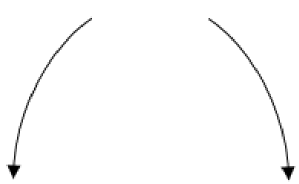




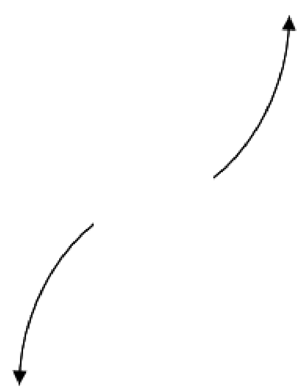
A.



C.



B.



D.

E. None of the above.

General Comment: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

---

26. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-5 + 5i \text{ and } -1$$

The solution is $x^3 + 11x^2 + 60x + 50$, which is option B.

A. $b \in [-16, -10], c \in [59, 67],$ and $d \in [-58, -48]$

$x^3 - 11x^2 + 60x - 50$, which corresponds to multiplying out $(x - (-5 + 5i))(x - (-5 - 5i))(x - 1)$.

B. $b \in [4, 19], c \in [59, 67]$, and $d \in [46, 58]$

* $x^3 + 11x^2 + 60x + 50$, which is the correct option.

C. $b \in [-8, 6], c \in [-1, 13]$, and $d \in [3, 6]$

$x^3 + x^2 + 6x + 5$, which corresponds to multiplying out $(x + 5)(x + 1)$.

D. $b \in [-8, 6], c \in [-6, 3]$, and $d \in [-7, 3]$

$x^3 + x^2 - 4x - 5$, which corresponds to multiplying out $(x - 5)(x + 1)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (-5 + 5i))(x - (-5 - 5i))(x - (-1))$.

---

27. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{-2}{5}, \frac{-3}{2}, \text{ and } \frac{1}{5}$$

The solution is $50x^3 + 85x^2 + 11x - 6$, which is option C.

A. $a \in [48, 62], b \in [44, 50], c \in [-44, -38]$, and $d \in [1, 10]$

$50x^3 + 45x^2 - 41x + 6$, which corresponds to multiplying out $(5x - 2)(2x + 3)(5x - 1)$.

B. $a \in [48, 62], b \in [-106, -98], c \in [42, 50]$, and $d \in [-8, 2]$

$50x^3 - 105x^2 + 49x - 6$, which corresponds to multiplying out $(5x - 2)(2x - 3)(5x - 1)$.

C. $a \in [48, 62], b \in [79, 88], c \in [7, 18]$, and $d \in [-8, 2]$

* $50x^3 + 85x^2 + 11x - 6$, which is the correct option.

D. $a \in [48, 62], b \in [79, 88], c \in [7, 18]$, and $d \in [1, 10]$

$50x^3 + 85x^2 + 11x + 6$, which corresponds to multiplying everything correctly except the constant term.

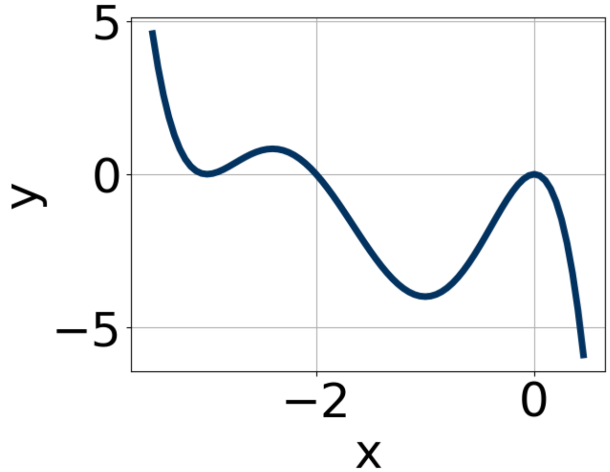
E. $a \in [48, 62], b \in [-85, -84], c \in [7, 18]$, and $d \in [1, 10]$

$50x^3 - 85x^2 + 11x + 6$, which corresponds to multiplying out $(5x - 2)(2x - 3)(5x + 1)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(5x + 2)(2x + 3)(5x - 1)$

---

28. Which of the following equations *could* be of the graph presented below?



The solution is $-13x^8(x+3)^{10}(x+2)^5$, which is option D.

A. $14x^{10}(x+3)^{10}(x+2)^5$

This corresponds to the leading coefficient being the opposite value than it should be.

B. $18x^{10}(x+3)^4(x+2)^4$

The factor $(x+2)$ should have an odd power and the leading coefficient should be the opposite sign.

C. $-11x^9(x+3)^6(x+2)^5$

The factor x should have an even power.

D. $-13x^8(x+3)^{10}(x+2)^5$

* This is the correct option.

E. $-8x^{11}(x+3)^{10}(x+2)^{10}$

The factor x should have an even power and the factor $(x+2)$ should have an odd power.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

---

29. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$4 - 3i \text{ and } 3$$

The solution is $x^3 - 11x^2 + 49x - 75$, which is option B.

A. $b \in [9, 12], c \in [40, 52], \text{ and } d \in [74, 86]$

$x^3 + 11x^2 + 49x + 75$, which corresponds to multiplying out $(x-(4-3i))(x-(4+3i))(x+3)$.

B. $b \in [-14, -5], c \in [40, 52], \text{ and } d \in [-77, -72]$

* $x^3 - 11x^2 + 49x - 75$, which is the correct option.

C. $b \in [0, 3], c \in [0, 5], \text{ and } d \in [-9, -8]$

$x^3 + x^2 - 9$, which corresponds to multiplying out $(x+3)(x-3)$.

D. $b \in [0, 3], c \in [-10, -6]$, and $d \in [7, 16]$

$x^3 + x^2 - 7x + 12$, which corresponds to multiplying out $(x - 4)(x - 3)$.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

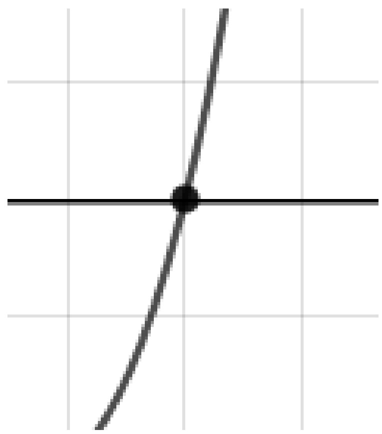
General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (4 - 3i))(x - (4 + 3i))(x - (3))$.

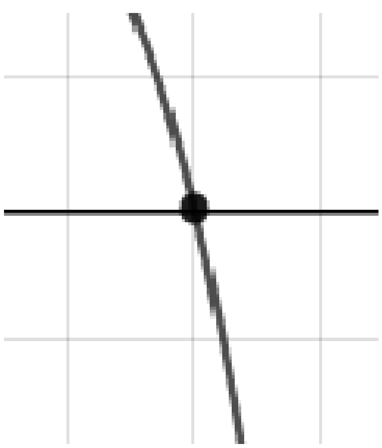
---

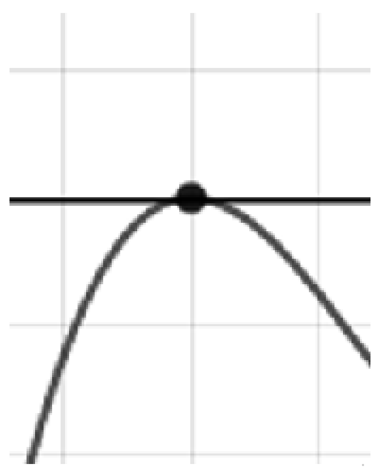
30. Describe the zero behavior of the zero $x = 3$ of the polynomial below.

$$f(x) = 3(x - 3)^5(x + 3)^{10}(x + 8)^5(x - 8)^6$$

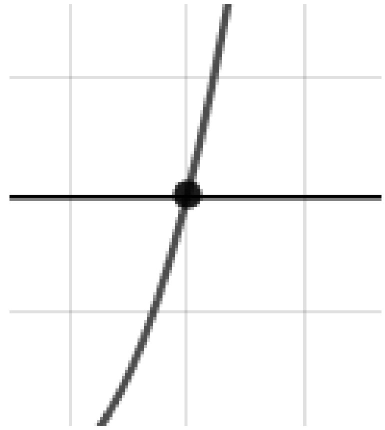
The solution is the graph below, which is option D.



A. 

B. 

C. 

D. 

E. None of the above.

General Comment: You will need to sketch the entire graph, then zoom in on the zero the question asks about.